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NOTICES OF NEW WORKS.

A Treatise on Annuities, with numerous Tables based on the Experience of the Equitable Society and on the Northampton Rate of Mortality. By the late GRIFFITH DAVIES, F.R.S., Actuary to the Guardian Assurance Company, &c. Charles and Edwin Layton, 150, Fleet Street.

THE executors of the late Mr. Davies have done the public and the profession good service by this issue of the remaining copies of his valuable work, which, with its preface, title page, and table of contents, now presents a much more finished appearance than heretofore. As the executors remark, the improvements which have been made of late years in the science of life assurance render some portions of the Treatise less useful than they might formerly have been; nevertheless, there is much in it which will possess interest for the general reader, and which is all but indispensible for the consideration of the professional student. In glancing over its pages we could not but be struck with the truth of the author's observations in reference to the merits respectively of the mutual and proprietary systems of life assurance. The defect which he alludes to in the former, and which he looked upon years ago as of so serious a character in the Equitable Society, has recently exhibited itself in a very marked manner in another important Institution similarly constituted. As Mr. Davies quaintly remarks, "the avaricious dispositions of the majority of those mutually assured" . . . . . "threaten to become not only insatiable, but incapable of being controlled by any other means than the overwhelming power of the Court of Chancery."

A Table of Quarter-Squares of all Integer Numbers up to 100,000, *by which the product of Two Factors may be found by the aid of Addition and Subtraction alone.* By SAMUEL LINN LAUNDY, A.I.A., Secretary of the London Mutual Life and Guarantee Society. Charles and Edwin Layton, 150, Fleet Street, London.

THIS is a very important publication, and the methods it enunciates will, no doubt, go far to supersede in many cases the use of logarithms. Mr. Laundy has evidently bestowed very considerable pains upon his work, and has left nothing undone to render it as perfect as possible. The mode of construction and the manner of using the tables are very fully explained in the introduction; and the preface, the greater part of which we are induced to extract, gives an interesting account of the present undertaking and of previous efforts in the same direction. Mr. Laundy says:—

"In December last the author had the honour of reading before the Institute of Actuaries a paper 'On a Method of finding the Product of two Factors by means of the Addition and Subtraction of Natural Numbers,'[*] in which he gave some account of the construction and use of the table forming the subject of the present work. The paper referred to was based upon the suggestions contained in an article contributed to the *Journal* of the Institute, entitled, 'On Multiplication by a Table of Single Entry,' by J. J. Sylvester, Esq., M.A., F.R.S.,[†] in which he shows that, by means of a table of squares, the product of any two numbers may be found 'by the aid of the processes of addition and subtraction alone, just as is the case in logarithmic computation, but with the advantage over that method of perfect precision in the result, and of the number of findings for each computation being only two in number—the third, and by far the most troublesome of the three findings, viz., that of finding back the number corresponding to the result of the linear (meaning thereby additive or subtractive) process, which occurs in the logarithmic, not arising in the method about to be explained.' . . . . .

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[*] *Assurance Magazine*, vol. vi., p. 121.

[†] *Assurance Magazine*, vol. iv., p. 236.

" It may be proper to remark, that at the time of the author's reading the paper before referred to, and until after he had made known his intention to publish, he was not aware of the existence of any similar table; and it was only through the courtesy of Mr. Peter Gray—so favourably known as the author of several valuable contributions to the science of life assurance—that his attention was drawn to the works of Voisin and Merpaut,* and the article 'Quarter-Squares' in the *Penny Cyclopædia*, as well as to an article by Professor Sylvester in the *London and Edinburgh Philosophical Magazine*, vol. vii., p. 430. It is also due to Mr. Gray to mention, that he has in his possession the MS. of a Table of Quarter-Squares by Major Shortrede, extending to 200,000. Had the author been sooner made aware of the existence of Major Shortrede's table, he would not willingly have encountered the labour of computing, and afterwards carrying through the press, the table contained in this volume.

" The article 'Quarter-Squares,' in the *Penny Cyclopædia*, mentions that a table of the fourth part of the squares of numbers may be substituted for one of logarithms in multiplication. For since $\frac{(a+b)^2}{4}-\frac{(a-b)^2}{4}=ab$, a table which gives the squares of the halves of numbers will, by the subtraction† of the squares of the halves, or quarter-squares, give the product; and it is added, that such a table had been published in France, and was introduced to a certain extent in the late Professor Leslie's *Philosophy of Arithmetic*.

" Turning to the latter work, the following remarks occur in the preface (2nd Edit., 1820): 'The most valuable addition I have made consists in the Table of Quarter-Squares, near the end of this volume, which, to a certain extent, performs the multiplication of numbers more expeditiously than even logarithms themselves.' And at page 257 it is added, 'This application of a table of quarter-squares, as it is derived from the simplest principles, might have readily occurred to a mathematician; yet I have nowhere seen it brought into practical use, till last summer I met with, at Paris, a small book by Antoine Voisin, printed in 1817.' Leslie then gives a Table of Quarter-Squares, from 1 to 2,000, as a specimen, and adds: 'It would be a great service, however, in facilitating many calculations, to have the whole table reprinted, or perhaps even extended to 200,000, which might be condensed into a moderate-sized volume.'

" The work of Voisin is entitled *Tables de Multiplications ou Logarithmes des Nombres Entiers depuis* 1 *jusqu'à* 20,000. In his preface, after mentioning the advantages to calculators afforded by logarithms, he remarks, 'L'admirable calcul de logarithmes indique, il est vrai, les moyens de trouver à quels nombres correspondent ceux qui surpassent les limites des tables, mais ces abréviations ne diminuent pas sensiblement le travail; aussi pour ces cas la méthode ordinaire a-t-elle prévalu. Les tables que nous offrons au public, en abrégeant considérablement les calculs, ont l'avantage de donner directement le produit de deux nombres, de servir de preuves aux opérations faites par les logarithmes ordinaires, et enfin d'indiquer les moyens de corriger les fautes qui auraient pu échapper aux lectures des épreuves.' And in his concluding remarks, Voisin proposed to publish a second volume, containing the '*logarithms*' of numbers (for so he is pleased to call them) from 20,000 to 100,000; but whether this intention was ever carried into practice, the author has not been able to ascertain. It may be remarked, that the arrangement adopted by Voisin is faulty, owing to the figures not being grouped, whereby it is rendered difficult accurately to set down numbers under those previously extracted in the course of an operation; as also, being in single vertical columns, the whole of the leading figures which remain constant for many successive numbers are necessarily repeated, and which would not have been required in the more convenient and compact form in which it is here presented.

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* The author is also indebted to Mr. E. Sang, for referring him to Voisin's tables.

† In the original article, the word *addition* was used, evidently by an oversight on the part of the author.

"Another work, having the same object as the last, is entitled *Tables Arithmonomiques fondées sur la rapport du rectangle au carré, ou Le Calcul réduit à son dernier degré de simplification*, par J. M. Merpaut, Professeur de Mathématiques Speciales au Collége de Vannes (à Vannes, 1832), and is designed to facilitate the processes of multiplication and division, by means of a table of quarter-squares from 1 to 40,000, and of a table of reciprocals from 1 to 10,000. The tables in this work are an improvement upon Voisin's, for the digits of each quarter-square and reciprocal are grouped in periods of three, as shown in the following example of the first and last lines of p. 228 of that table:—

22,8

	0	1	2	3	4	5	6	7	8	9
0	129 960 000	130 074 025	130 188 100	130 302 225	130 416 400	130 530 625	130 644 900	130 759 225	130 873 600	130 988 025
* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *
9	130 062 620	130 176 690	130 290 810	130 404 980	130 519 200	130 633 470	130 747 790	130 862 160	130 976 580	131 091 050

"From which it will be seen that the first three figures of the argument are to be sought at the head of the table, the fourth figure at the head of one of the vertical columns, in which, and even with the final figure in the column at the left hand, will be found the quarter-square required; thus, the quarter-square of 22890 is 130988025, and the quarter-square of 22859 is 1306334710. This arrangement, although peculiar and somewhat inconvenient, is superior to that of Voisin's, but is open to the objection of occupying much space, and does not save the repetition of the constant figures occurring at the beginning of many successive quarter-squares. In addition to the method of using the table as explained by Voisin, the author has also shown the mode of obtaining the quarter-squares of numbers, and the products of numbers, beyond the limits of the table, by the aid of numbers therein tabulated, which adds materially to its utility in such cases.

"The only other work known to the present author, in which a table of quarter-squares is inserted or referred to, is Galbraith's *General Tables*, 2nd Edit., 1836 (intended as a supplement to the second edition of his *Mathematical and Astronomical Tables*), in which, at p. 17, the following observations are made:—'Table XXXIV.* will be found very useful for obtaining the products of numbers in general, and of those employed in the preceding [astronomical] calculations in particular. In many instances, calculations may be performed more readily by this table than by logarithms. . . . . Besides, in using this table the differences of the sums set down are the results required, whereas the corresponding natural numbers must first be found from a table of logarithms, in searching for which a considerable time is often necessary.' The author also observes, that 'he has given to the table double arguments, both in natural and sexagesimal numbers, which he hoped would render its utility still more extensive than that given originally by Voisin'; and adds, that 'it will also be found, in conjunction with a traverse table, to be highly useful in surveying with a compass, as practised in uncleared countries, or newly discovered islands circumnavigated by a boat, or any small-decked vessel whose courses and distances are carefully kept, and the area in square miles is required tolerably near the truth.' And, finally, he draws attention to the utility of the table for facilitating the calculations of surveyors.

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* Quarter-Squares of Numbers from 1 to 3149.

"It is not a little remarkable, that Leslie and Galbraith both repeat an error which occurs in Voisin's table, thus showing beyond doubt that they merely reprinted from Voisin. The error referred to is in the quarter-square of 747, which in all three works appears as 139052, the correct number being 139502."

Mr. Laundy adds, that he "has taken considerable pains to render the Table as accurate as possible. Having been entirely calculated in duplicate, the types were set up from one of the workings, and the proofs were read against the duplicate. After correction, the several pages were stereotyped, and proofs from the plates were again read against the duplicate; defective figures were then marked and corrected, and, finally, the sheets were printed from the stereotype plates. From the careful revision the table has thus undergone, it is believed that it will be found as free from errors of every kind as any similar work of equal extent."

The following example will show the arrangement of Mr. Laundy's table, and will exhibit the tabular values of the entering numbers.

N. 50,000—50,499.

13° 53′	N.	0	1	2	3	4	5	6	7	8	9
″ 20	**5000**	625 0000 00	0250 00	0500 01	0750 02	1000 04	1250 06	1500 09	1750 12	2000 16	2250 20
30	1	2500 25	2750 30	3000 36	3250 42	3500 49	3750 56	4000 64	4250 72	4500 81	4750 90
40	2	5001 00	5251 10	5501 21	5751 32	6001 44	6251 56	6501 69	6751 82	7001 96	7252 10
50	3	7502 25	7752 40	8002 56	8252 72	8502 89	8753 06	9003 24	9253 42	9503 61	9753 80
13° 54′	4	626 0004 00	0254 20	0504 41	0754 62	1004 84	1255 06	1505 29	1755 52	2005 76	2256 00
10	5	2506 25	2756 50	3006 76	3257 02	3507 29	3757 56	4007 84	4258 12	4508 41	4758 70
20	6	5009 00	5259 30	5509 61	5759 92	6010 24	6260 56	6510 89	6761 22	7011 56	7261 90
30	7	7512 25	7762 60	8012 96	8263 32	8513 69	8764 06	9014 44	9264 82	6515 21	9765 60
40	8	627 0016 00	0266 40	0516 81	0767 22	1017 64	1268 06	1518 49	1768 92	2019 36	2269 80
50	9	2520 25	2770 70	3021 16	3271 62	3522 09	3772 56	4023 04	4273 52	4524 01	4774 50

There can be no doubt that these tables, as is suggested, will be found useful both in the study of the practical computer and in the counting-house of the merchant; and that they will facilitate, by the use of decimal arithmetic, a vast number of calculations occurring in commerce as well as in the sciences. The work, and the manner in which it is produced, are highly creditable to Mr. Laundy; and we heartily wish that the undertaking may meet with the success it so well deserves.